THE ADOLESCENT SPORT NUTRITION KNOWLEDGE QUESTIONNAIRE: VALIDITY AND RELIABILITY

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THE ADOLESCENT SPORT NUTRITION KNOWLEDGE QUESTIONNAIRE: VALIDITY AND RELIABILITY

by

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This thesis has been read by each member of the following supervisory committee and by majority vote has been found to be satisfactory.

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FINAL READING APPROVAL

To the Graduate Council of the University of Utah:

I have read the thesis of Theresa E. Dvorak in its final form and have found that (1) its format, citations, and bibliographic style are consistent and acceptable; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the supervisory committee and is ready for submission to The Graduate School.

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ABSTRACT

Over the past three decades adolescents have increasingly become involved in athletics. Previous research assessed the level of sport nutrition knowledge among these youth. However, most of the tools that were used did not undergo rigorous analysis to ensure valid and reliable assessment of these young athletes' knowledge. The purpose of this study was to develop the Adolescent Sport Nutrition Knowledge Questionnaire and establish validity and reliability. The instrument consists of three sections: 1) demographics and history of sport participation; 2) questions related to nutrition attitudes and behaviors; 3) a 63-item true/false/unknown test of sport nutrition knowledge for seven varying subscales. A panel of ten experts evaluated the developed questionnaire and established construct validity. A group of 42 university students established predictive validity between the two groups with distinct knowledge differences (r^2=0.05; p=0.78). In this study, 138 adolescent male and female participants (mean age: 15.6 ± 1.16 years old) completed the questionnaire once, and 42 of these individuals completed it a second time to establish the tools reliability. The average sport nutrition knowledge score was 41.72 ± 7.81; n=134. Internal consistency of the tool was 0.86 with a narrow 95% confidence interval of 0.74-0.92 displaying a 'good' level of reliability; however, the individual subscales were not independently reliable. Analysis of the individual questions provides evidence that there is a low level of understanding of nutritional recommendations for athletes. Stepwise multiple regression revealed age (p=0.004) and 'parents as the primary source of nutrition information' (p=0.002) as

predictors of sport nutrition knowledge (r^2=0.16; explaining 16% of the variance). This study suggests that the Sport Nutrition Knowledge Questionnaire is a valid and reliable tool to assess overall sport nutrition knowledge in adolescent athletes. However, further development of the subscales would need to be conducted to assess knowledge within these individual constructs. Sports dietitians, coaches and athletic trainers can utilize this tool to assess knowledge in adolescent athletes and to test the efficacy of sport nutrition interventions among athletes and teams.

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

During the 2005-06 school year, approximately 7.2 million high school students competed in athletics, with nearly 60% being male and 40% female. This figure represents a 180% increase in participation since the 1971-72 season (1). These young individuals participate in athletics not only to experience a competitive edge, but also for the enjoyment of sport, weight loss, and social involvement. Furthermore, many sedentary adolescents are encouraged to play sports to offset the risk of being overweight. However, with this rise in sports participation comes a responsibility to improve the education of these athletes to ensure safe and healthy training practices. An important area of education is that of general and sport-specific nutrition, given the increased requirement for adequate nutrition to support growth and development and support training during adolescence (2-4).

Research has previously determined that the nutritional needs of adolescent athletes differ from that of their nonathletic and adult counterparts. These changes include an increased need for energy and protein to support adequate growth and development, ensuring training adaptation, and enhancing sport performance (3, 4). The primary substrates used by the muscle during exercise are carbohydrates and free fatty-acids. Distribution of these substrates is dependent on the intensity and duration of the exercise; however, there appears to be a greater rate of fat oxidation in the adolescent population rather than in adults. Adolescents also generate more metabolic heat when

compared to adults with respect to body mass due to their greater surface to mass ratio. In addition, adolescents have a lower sweat rate when compared with adults, which increases the risk of dehydration in these young athletes (4). Furthermore, it has been found that there may be an increased requirement for iron intake for the adolescent athlete. When the adolescent athlete was compared with the nonathlete, lower levels of erythrocyte count, packed cell volume and hemoglobin concentrations, regardless of sex, were found (5). In general, it has been noted that adolescents have lower calcium intakes, most consuming only slightly over 50% of the adequate intake (3). The athlete requires calcium for optimal bone formation, and for muscle contraction. Thus, optimal calcium intake is critical for supporting normal growth and development along with peak athletic performance.

As more adolescent research is conducted, it is important to educate young athletes who may be unaware of the potential negative health risks that can arise from inadequate nutrition while participating in sports. Research indicates that the adolescent athlete may be at risk for developing nutritional insufficiencies due to inadequate intake of both macro- and micronutrients (5, 6). Specifically, these young individuals may be prone to a lower appetite and thirst drive during the competitive season or in the heat when training volume and intensity is fairly high (4). Given that many young athletes are involved in multiple sports or training programs throughout the year, there is a general lack of a true recovery period in which the athlete can rest for more than a week to rebuild the body without the additional stress of athletics. Although adolescent athletes may be at risk for inadequate nutritional status while involved in intense athletics, there is no question that these athletes benefit greatly from their active lifestyle. There are many

health benefits to sports participation; these include cardiovascular health, acquisition of lean body mass, psychological development, and increased self-confidence (2, 3, 7, 8). The key to the adolescent athlete's optimal development is to provide an environment that promotes safe sports participation that is supported by an interdisciplinary approach, of which nutrition education is an integral aspect.

There is a growing desire to perform at peak levels for adolescent athletes as well. Athletes always seem to look for ways to improve their performance. They maximize their sport-specific training regimen, employ psychological techniques, and may pursue the use of dietary and sport supplements to improve their performance. Within this aspect, the application of sport nutrition principles to one's sport has gained publicity among athletic populations as a safe way to enhance performance. Multiple publications exist that describe the sport nutrition recommendations for athletic populations, including adolescents. The Position of the American College of Sports Medicine, American Dietetic Association, and Dietitians of Canada published in 2000 states that, "physical activity, athletic performance, and recovery from exercise are enhanced by optimal nutrition." Further, the authors of the position recommend "an appropriate selection of food and fluids, considering the timing of intake, and supplement choices for optimal health and exercise performance" (9).

The current level of sport nutrition knowledge among adolescent athletes is poorly understood. Previously developed assessment instruments found low levels of sports nutrition knowledge among athletes, particularly within the adolescent population (6, 10-20). Research studies identified positive correlations between the level of physical activity and nutrition knowledge (11, 12) and between level of nutrition education and

nutrition knowledge (12, 18). Among athletes aged 14-18 years, a positive relationship has been found between nutrition knowledge and eating behaviors for athletes (13). This study found that athletes engage in better eating practices, particularly with respect to carbohydrate intake, prior to competition if they receive adequate nutrition education, with an emphasis on sport nutrition (13). This enhanced knowledge has the potential to lead to positive behaviors. Several research studies have assessed the adolescent athletes' knowledge of both general nutrition (13, 16) and dietary supplements (14, 15, 19). However, the studies on general nutrition used a survey modified from a previous questionnaire by Werblow et al. (1978), which was developed to assess nutrition knowledge of female collegiate athletes (18). Furthermore, these studies used self-developed questions to assess dietary supplement knowledge, which were not tested for validity or reliability. Thus, there is currently no tool available that can be used to measure sport nutrition knowledge in adolescent athletes.

The lack of a common tool for the assessment of nutrition knowledge makes it difficult to measure baseline knowledge and the success of intervention programs that aim to improve nutrition knowledge and skill in the adolescent athlete population. It is imperative, therefore, to develop a valid and reliable instrument.

To our knowledge, there is no valid and reliable questionnaire to assess sport nutrition knowledge of the adolescent athlete. Furthermore, we are unaware of a questionnaire that assesses general and sport-specific nutrition knowledge and knowledge on dietary supplements, the attitudes and behaviors related to eating and sport in young athletes, along with a subscale designed to determine the ability of the athlete to apply sport nutrition guidelines to a practical sport setting.

Thus, the primary objective of this study is to develop a valid and reliable assessment tool designed to assist professionals (e.g., sports dietitians, coaches, and athletic trainers) working with adolescent athletes. The tool will assess the level of sport nutrition knowledge of athletes, their attitudes and behaviors related to eating and sports, and the individual's ability to practically apply his/her sport nutrition knowledge to specific sport settings.

METHODOLOGY

The purpose of this study was to develop a valid and reliable sport nutrition knowledge questionnaire for the adolescent athletes. The process included creating questionnaire items, determining content validity and establishing reliability of the instrument.

Participants

Validity

Sports dietitians who are actively engaged in sport nutrition targeting adolescent athletes, sport nutrition, and/or experts in questionnaire development were recruited to participate on the expert panel. The expert panel (n=10) evaluated each question within the behavior and attitudes section along with the seven subscales. Participants for the predictive validation process were Master of Science in Nutrition students who specialize in Sport Nutrition and undergraduate university students enrolled in an advanced-nutrition course who had already taken basic nutrition (n=42). It was assumed that all of these students had successfully completed a prerequisite basic nutrition course.

Reliability

For the test-retest reliability process, 138 adolescent male and female athletes aged 14-19 years were recruited and 42 were asked to complete the questionnaire a second time. Participants had to be currently involved in at least one competitive sport.

This study was approved through the Institutional Review Board of the University of Utah. After validation of the questionnaire and approval of the amended questionnaire through the University of Utah's IRB, personal contact, flyers, announcements and word of mouth were used to recruit participants. The recruitment flyers were provided to local athletic trainers and coaches who distributed the flyers to local athletic teams. Inclusion criteria for participants consisted of the following: an adolescent male or female, age 14-19 years old, enrolled in a high school grade 9-12, and an athlete who has participated in at least one competitive sport. All participants provided written consent prior to participation. Due to the low level of invasiveness, this study was exempt from parental consent.

Study Procedures

Questionnaire Development

The principal investigator designed the Adolescent Sport Nutrition Knowledge Questionnaire with the assistance of experts in the field and previously published literature (19, 21, 22). Furthermore, a previously developed survey was used to assist with the framework of the questionnaire (21, 22). The Adolescent Sport Nutrition Knowledge Questionnaire is comprised of three sections and seven subscales. The first section focused on demographic information (e.g., age, gender, ethnicity, education level of the subject and his/her parents, extent of sport participation, and extent of prior nutrition education) and it consisted of 12 open-ended and Likert-scale questions. The second section focused on the participants' attitudes and behaviors related to sport nutrition; this section contained 16 open-ended and Likert-scale questions. The third

section was comprised of seven subscales designed to test the athlete's sport nutrition knowledge with 63 true/false/unknown questions. The first subscale included questions related to the identification of energy sources required for various athletic activities, energy balance in sport, and energy (calorie) content of macronutrients. The next three subscales assessed the participant's knowledge related to macro- and micronutrients and hydration, and identifying their food sources, functions, and sport-specific recommendations. The fifth subscale tested the participant's knowledge related to the training and competition meal. Specifically, questions addressed issues of timing and the purpose of pre-training and pre-event meals. The sixth subscale assessed the participant's dietary and sport supplement knowledge. Finally, the seventh subscale of the questionnaire evaluated the participant's ability to apply his/her sport nutrition knowledge to the practical setting. The seven subscales were scored with correct answers receiving a score of 1 whereas incorrect and unknown answers received a score of 0. Also an assumption was made that if the participant selected the 'unknown' option that he/she did not possess the specific knowledge, and this lack of knowledge would be reflected in the overall score. The questions from the seven subscales were placed in random order on the questionnaire. The complete Sport Nutrition Knowledge Questionnaire is found in Appendix A.

Validation of Questionnaire

Ten sport nutrition experts established construct validity of the questionnaire. These individuals were asked to complete the expert questionnaire form, which ranked each item's relevancy, readability, level of difficulty and appropriateness. Experts were

also asked to provide comments regarding the validity of the instrument (Appendix A). This method of construct validity had been successfully used in a previous study that developed a nutrition knowledge questionnaire (23). The returned expert questionnaires were compiled along with comments from the pilot testing, and appropriate adjustments were made to the Adolescent Sport Nutrition Knowledge Questionnaire to ensure that it is a valid instrument for a high school (grade 9-12) adolescent athlete population. Adolescent male and female athletes aged 14-19 years who participated in at least one competitive sport were recruited for pilot testing of the questionnaire to assess the readability of the individual questions (n=16).

Graduate and undergraduate university students (n=42) established predictive validity of the questionnaire. All of these individuals received written instructions on how to complete the Adolescent Sport Nutrition Knowledge Questionnaire.

Reliability of Questionnaire

The adolescent athletes (n=138) were asked to complete the questionnaire, and 42 were asked to take the questionnaire twice, 2 weeks apart. Participants were given verbal and/or written instructions to familiarize them with the purpose of the questionnaire and an overview of the instructions to ensure completion of the questionnaire following a regularly scheduled training session.

Statistical Analysis

Pearson product moment correlations were used to determine the predictive validity between the adolescent athletes and the graduate and undergraduate students. Intraclass correlation coefficients using Cronbach's alpha, based on a two-way mixed

analysis of variance (ANOVA) model, were used to establish internal consistency and test-retest reliability of the instrument. Internal consistency assessed each individual question. For test-retest reliability, subscale and total knowledge score were summed where each correct answer was given a value of 1 and each incorrect or unknown answer a value of 0. Test-retest reliability was analyzed using the summed scores (maximum score of 63) that were established for each subscale and overall total knowledge score. Factor analysis was performed to better understand the level of reliability between the subscales. Descriptive statistics were also analyzed using frequencies and are reported as percentages.

To identify potential predictors of sport nutrition knowledge, Pearson product moment correlations were used to determine significance between independent variables (e.g. age, gender, high school grade level, parental education level, family meals, and dietary behaviors and attitudes) and total sport nutrition knowledge score. After potential predictors of sport nutrition knowledge were identified, a multiple stepwise regression model was used to determine the strength of prediction for the recognized independent variables. For all analyses, the significance level was set at $\alpha=0.05$. All statistical analyses were conducted using the Statistical Package for the Social Sciences (Version 15, SPSS, Inc, Chicago, IL).

RESULTS

Sport Nutrition Knowledge Score

The summed sport nutrition knowledge score ranged from 26 to 60 with a possible 63 correct responses (mean=41.72 ± 7.81; n=134). Thirty-two percent of the scores were less than 60% correct. Scores were normally distributed across the sample population.

Participant Descriptive Statistics

Following recruitment from local sport teams (soccer, swimming, softball, Alpine and Nordic skiing) 138 adolescent participants aged 14-19 (mean age =15.6 ± 1.2y) agreed to be involved in the study. The distribution of the adolescent participants was as follows: 43% male, 57% female, 39% freshmen, 30% sophomores, 18% juniors, and 12% seniors in high school, and mostly were Caucasian (87%), with other ethnic groups including 4% Hispanic, 3% Asian, 1% Native American, 5% others.

Predictive Validity

In order to determine the predictive validity of the tool, 42 college students also participated in the study. These individuals ranged in age from 18 to 37 years (mean age: 24.6 ± 4.20y). Of the sample 33% were male, 67% female, and the majority were Caucasian (76%), with the rest representing other backgrounds (African American, Hispanic, Asian, Native American). The sport nutrition knowledge scores for the college students ranged from 34 to 61 (mean score: 50.24 ± 7.04), and 10% of the scores were

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Caucasian in this study did not include Hispanic.

less than 60% correct. Pearson's Product Moment correlation coefficients showed that the mean score of the college students was not significantly correlated to the mean score of the adolescent athlete population (r^2=0.05; p=0.78).

Reliability of Instrument

The internal consistency of the tool was 0.86 with a narrow 95% confidence interval of 0.74 - 0.92. Cohen states that a standard error of measurement (calculated with Crohnbach's alpha) >0.80 displays 'good' reliability of the tool (24). The two-way mixed ANOVA model (assuming that the questions are fixed and the subjects are randomly selected) was used to estimate the mean stability of the 63-question survey for a sample size of 42. This model showed that the questionnaire was not mean stable, p=0.11.

Of the 138 adolescent participants, 42 completed the questionnaire a second time at least two weeks apart from the first admission. The mean retest knowledge score was 42.76 ± 8.53. Table 1 shows the test-retest reliability of the questionnaire as a whole and within the individual subscales. Crohnbach's alpha intraclass reliability statistic (0.86, p<0.001) and mean stability were calculated.

Internal consistency, shown in Table 1, for the individual subscales ranged from 0.17-0.55 which, according to Cohen, are considered less than 'poor' reliability (24). Principal Components factor analysis revealed 24 latent factors in the 63-item survey designed to have 7 constructs.

Table 2 displays the intercorrelations of the Sport Nutrition Knowledge Questionnaire and subscales. All of the subscales are correlated with each other and each

Table 1

Internal Consistency of the Sport Nutrition Knowledge Questionnaire and Subscales

	Test 1				Test-Retest[a]			
Subscale	N	ICC[a]	CI[b]	*p*	N	ICC[a]	CI[b]	*p*
1. Hydration	138	.17	-.05-.37	.061	44	.61	.28-.79	.001*
2. Energy Sources and Balance	138	.48	.34-.60	<.001*	44	.76	.56-.87	<.001*
3. Micronutrient Knowledge	138	.54	.42-.65	<.001*	44	.72	.48-.84	<.001*
4. Macronutrient Knowledge	136	.36	.18-.51	<.001*	43	.74	.52-.86	<.001*
5. Supplements and Steroids	136	.55	.43-.66	<.001*	44	.73	.50-.85	<.001*
6. Training/ Competition Meal	138	.55	.43-.66	<.001*	44	.70	.45-.84	<.001*
7. Practical	138	.31	.12-.47	.001*	43	.74	.52-.86	<.001*
8. Total Score	134	.83	.78-.87	<.001*		.86	.74-.92	<.001*

[a] Intraclass coefficient (Cronbach's alpha). [b] 95% confidence interval.
* $p<0.05$

Table 2

Intercorrelations of the Sport Nutrition Knowledge Questionnaire and Subscales[a]

Subscale	1	2	3	4	5	6	7	8
1. Hydration		.27**	.31**	.20*	.20*	.19*	.38**	49**
2. Energy Sources and Balance			.43**	40**	.30**	.54**	.37**	.71**
3. Micronutrient Knowledge				44**	.30**	44**	.40**	.74**
4. Macronutrient Knowledge					.37**	.48**	.43**	.71**
5. Supplements and Steroids						29**	.37**	.63**
6. Training/ Competition Meal							.44**	.74**
7. Practical								.69**
8. Total Knowledge Score								

[a] $N = 134$.
*$p<0.05$ (two-tailed). ** $p<0.01$ (two-tailed).

subscale is significantly correlated with the total sport nutrition knowledge score ($p<0.05$).

Questionnaire Findings

Sport Participation

Athletes had been involved in sports for an average of 8.9 ± 3.0 years and 48% reported playing on two athletic teams in the last year while 23% played on three or more teams. Seventy percent of the athletes participated in more than two different sports for at least one season.

Sources of Nutrition Education/ Information

Less than half (46%) of all athletes reported attending at least one nutrition-related class, seminar, or individual nutrition counseling. The three most frequently stated primary sources of nutrition information were from the individual's parents (38%), coaches (16%), and health/medical professionals (6.5%).

Food and Eating Related Behaviors

When nutrition behaviors were further assessed, 56% of the athletes reported shopping for groceries at least one time in the past week, whereas 74% helped to prepare food for dinner at least once in the past week. Over half of the participants (54%) reported eating at least five meals with the family within the past seven days, whereas 7% stated no family meals. Fifty-six percent of the athletes reported eating breakfast seven days a week. Merely a quarter of the sample reported 'never' skipping meals (breakfast, lunch, dinner), and when asked how many times he/she ate per day, 47% of athletes

acknowledged eating more than five times per day and 46% reported eating three to four times per day. The participants were asked how many days per week they brought lunch from home and only 36% of athletes reported bringing a lunch to school at least five days per week, whereas 44% reported never bringing lunch from home.

Nutrition Attitudes

It was found that the majority of adolescents believed that healthful eating plays a role in improving sport performance (73%), and 75% mentioned that eating healthful foods were 'often' or 'always' important to them.

Hydration and Recovery Nutrition

Only 28% of the athletes stated using a sport drink during practice often or always. The majority of athletes consumed food within an hour of practice or competition (65%) whereas approximately half of the athletes consumed a beverage with calories within 1 hour after practice or competition (49%).

Food Choices

Sixteen percent of the population stated eating fast food more than three times per week and 40% stated never eating fast food. When eating out, 37% of athletes primarily chose high-fat foods (pizza, hamburger/fries, or hot dog/chicken nuggets), whereas 20% reported selecting a deli style sandwich. The participants were also asked to estimate how many servings/cups/pieces of fruits and vegetables they consumed per day. It was found that 36% ate at least three servings of fruit and 25% ate at least three servings of

vegetables daily, whereas 57% ate one to two servings of fruit per day and 68% ate one to two servings of vegetables per day.

The ranges of sport nutrition knowledge scores within each of the individual subscales are shown in Table 3 as the mean score. The sample population had the highest level of knowledge for the hydration, training/competition meal and micronutrient subscales. However, knowledge in the remaining four subscales was lower.

Table 4 displays a sampling of the questions that were asked on the Sport Nutrition Knowledge Questionnaire and the corresponding percentage of participants who answered the question correctly.

A multiple stepwise regression model was used to determine which of the independent variables were potential predictors of the summed sport nutrition knowledge score. Table 5 lists the independent variables that were found to be significantly correlated with the summed sport nutrition knowledge score ($p<0.05$). When these variables were placed in the regression model, only two ('age' and 'parents as primary source of nutrition information') were found to be predictors of the sport nutrition knowledge score (Table 6). Even though these two variables contained enough prediction strength to be placed in the model both only explained 16% of the variance found in total sport nutrition knowledge scores.

The prediction equation was as follows: Predicted Sport Nutrition Knowledge Score = 15.15 - 4.63 ('Parent as primary source of nutrition information') + 1.86 (Age).

Table 3.

Sport Nutrition Knowledge of Adolescent Athletes by Subscale

Subscale (# of questions within)	Mean Score ± SD	Score Range (Min.-Max.)
Energy Sources and Energy Balance (8)	5.0 ± 1.7	1-8
Hydration Knowledge (8)	6.1 ± 1.2	3-8
Micronutrient Knowledge (12)	8.2 ± 2.0	4-12
Macronutrient Knowledge (10)	6.6 ± 1.5	2-10
Supplement and Steroid Knowledge (8)	4.6 ± 1.8	1-8
Training/Competition Meal (9)	6.2 ± 1.8	1-9
Practical (8)	4.8 ± 1.7	2-8
Total Knowledge Score (63)	41.7 ± 7.8	26-60

Table 4.

Sample Questions of Sport Nutrition Knowledge of Adolescent Athletes

Question	% Correct
Protein is the most important source of energy (calories) for sport performance. *False*	34
Sport drinks are important to consume during intense practices longer than 60-90 minutes. *True*	65
The B vitamins are important for turning the food you eat into energy. *True*	50
Calcium is important for bone health. *True*	97
Feeling tired midway through a workout may be a sign of not eating enough food (calories). *True*	60
Carbohydrates (stored as muscle glycogen) are the most important energy source for high-intensity exercise. *True*	70
An athlete's pre-training or pre-competition meal should be high in protein. *False*	28
Dehydration can negatively affect performance. *True*	96
For 1 pound of weight loss after exercise an athlete should drink at least 3 cups (24 oz) of fluid. *True*	54
How much an athlete sweats during exercise can be measured from the change in body weight before and after exercise. *True*	41
Athletes should limit the amount of salt they consume. *False*	20

Table 4-*Continued*

Question	% Correct
Milk is a good source of calcium. *True*	95
Oils from plants, fish, nuts and seeds are considered healthful fats. *True*	89
Taking steroids can cause acne, high cholesterol, and increased aggression. *True*	82
During exercise in the heat, drinking water is **better** than drinking sport drinks to maintain hydration. *False*	27
Vegetarian athletes need to consume a daily protein supplement because they cannot get enough protein from their diet. *False*	16
Creatine is an effective and safe supplement for athletes to take at any age. *False*	43
White bread has the same amount of vitamins and minerals as whole wheat bread. *False*	88
To gain weight, an athlete has to eat more food (energy) than used for exercise and body functions. *True*	65
Carbohydrates are the main source of fuel for mental performance. *True*	46
Weight loss occurs from not eating enough, exercising too much, or both. *True*	77
Vitamins and minerals provide energy (calories). *False*	40
Dietary supplements are tested for purity (cleanliness) and safety before sale. *False*	24

Table 4-*Continued*

Question	% Correct
Fruit juice is an ideal source of carbohydrate during practice. *False*	49
Most athletes require about four times more protein than nonathletes. *False*	14
Eating a poor diet may increase an athlete's risk for injury or illness. *True*	92
Sport products (drinks, bars, gels) are **not** considered dietary supplements. *False*	37
Iron is found in meat, dark green vegetables, eggs, and fortified cereal. *True*	76
Consuming a snack or beverage with calories before weight lifting will promote muscle building. *True*	55
Refueling immediately after exercise with a sport drink and snack optimizes recovery. *True*	77
Whole milk is better source of calcium than 2% or skim milk. *False*	40

Table 5.

*List of Potential Predictors for Sport Nutrition Knowledge Score**

Variable
Age of Participant
Number of Organized Sports in which the participant was involved for at least one season
Parents as primary source of nutrition information/education
Father's Highest Level of Completed Education
Mother's Highest Level of Completed Education
High belief that healthful eating plays a role in improving sport performance
Average number of days per week the participant brought lunch from home
Number of cups/servings of vegetables eaten per day
Healthful eating is important to the participant
Number of times the participant helped shop for groceries in the past week

*$p<0.05$

Table 6.

Multiple Regression for Potential Predictors of Sport Nutrition Knowledge

Model	Unstandardized Coefficient: B	Standardized Coefficient: ß	*p*	r^2
Parents as primary source of nutrition information	-4.63	-.28	.002**	
Age	1.86	.26	.004**	
Model Summary				.16

N = 106.
**$p<0.01$

DISCUSSION

The above results display that when the adolescent athlete population was analyzed with the university students, there is good predictive validity of the Sport Nutrition Knowledge Questionnaire, as there was no significant correlation between the level of knowledge of the two populations, as would be expected, and further validates the questionnaire.

The questionnaire demonstrated overall internal consistency; however, it did not possess mean stability. This implies low measurement error associated with the 63 items but has a potential systematic error. This could have been due to the homogeneity of the population or that the questions were too similar in level of difficulty. With a narrow 95% confidence interval, we can be fairly confident that the true knowledge score of the adolescent athlete population is within the stated range since most of the answers provided were similar between the test and retest, indicating precision of the tool.

The low intraclass coefficient for the subscales maybe explained by the small number of items in each subscale, participant homogeneity, too much overlap making it difficult to separate the questions into different constructs that are independently reliable. Even though it was attempted in the study design to have a heterogeneous sample, the participants were primarily 15 and 16 years old, more than half were female and most athletes were Caucasian. Future exploratory factor analysis is needed if the subscales are to be used as reliable assessment tools independently; however, as it is written with the

three sections and seven knowledge subscales it is reliable for summed sport nutrition knowledge. It was also determined that some of the items within the subscales were not highly correlated with each other, meaning that the questions did not measure the same construct of knowledge, the question was too difficult, or that there were not enough questions within the construct. For example, in the hydration subscale, some of the items had higher correct response means and when they were removed the intraclass correlation increased, however, still not to a 'good' level of reliability. Thus, further development of the subscales and individual questions is warranted if independent use of the constructs is desired.

When assessing the percentage of correct responses for the individual questions, it appears that some of the questions may have been too easy for this population. These data show that there were questions that could be considered low and high-level sport nutrition knowledge, given the relatively low or high scores for various questions. These relatively high scores may have also contributed to the low reliability of the individual subscales within the tool. Further analysis of the individual questions and subscales are necessary in order to improve the reliability of the independent subscales.

When assessing level of knowledge of this adolescent population, it appears from the responses to questions regarding the basic nutritional needs of athletes when compared to nonathletes that there is an understanding that an athlete has increased nutritional needs. However, there are misconceptions as to the degree of difference. An example of this skewed understanding is displayed in the question, 'most athletes require about four times more protein than nonathletes' where only 14% of the sample was able to correctly distinguish this question as 'false.'

Presently, we determined that there is a relatively low level of sport nutrition knowledge among high school aged athletes. This supports previous research that aimed to better understand the knowledge level of these athletes (8-19). Our findings also support studies that has reported significant correlations between level of physical activity and nutrition knowledge (9,10), given the significant correlation between the question 'number of sports in which you have participated for at least one season' and total knowledge score ($p<0.05$). The present study, however, did not find a significant correlation between increased level of nutrition education and nutrition knowledge as was found in previous research (10,17). This may be due to the different curricula that are taught among school districts, and the level of emphasis on both general and sport specific nutrition education.

The above data support the previously determined significant correlation between positive eating behaviors for athletes and nutrition knowledge (11). Positive correlations were found among the behaviors of bringing lunch from home, increased consumption of vegetables, grocery shopping along with the positive attitudes of importance of eating healthful foods and the belief that healthful eating plays a role in improving sport performance. Even though the above significant correlations were not strong predictors of sport nutrition knowledge, the information as to positive attitudes and behaviors should be reinforced during educational opportunities. Furthermore, there may be a connection between the degree of change in behaviors or attitudes following sport nutrition education or intervention that may be either significantly correlated to or a predictor of level of sport nutrition knowledge. Future research would need to be conducted in order to determine any potential relationship.

Regarding the level of supplement and steroid knowledge of the assessed population, there appears to be low knowledge pertaining to supplement guidelines, effectiveness, and regulation. This is shown in the misconception that sport products are not considered supplements, and 76% of the participants incorrectly stated that dietary supplements are tested for purity and safety before sale. These misconceptions are similar to findings in other studies that have assessed supplement knowledge (14,18). However, there seems to be a higher level of knowledge with regard to moderate and high-risk supplements and steroids. This is evidenced by 88% of the participants correctly answering 'false' to the question, 'there are **no** side effects associated with short-term steroid use.' The majority of the participants (82%) were also able to correctly identify that taking steroids can cause acne, high cholesterol and increased aggression. There appears to be a misconception that creatine is an effective and safe supplement for athletes to take at any age, which support previous research findings (18). These data suggest that supplement education may, in the past, have been focused on addressing the danger of high-risk supplements, rather than information regarding low-risk and possibly more commonly used supplements such as sport products, vitamin and mineral supplements, or specific supplement use and recommendations (e.g., creatine).

The low variance explained in the regression model implies that there are other factors that were not explored in the current study that may be stronger predictors of sport nutrition knowledge scores. Other factors may include competition level of the athlete, socioeconomic status of the adolescent's parents, nutrition and exercise curriculum that is taught within nutrition related courses, macronutrient meal composition, or potential other reasons or behaviors.

Overall, the relatively low sport nutrition knowledge level of the majority of the adolescent athlete population warrants education and interventions designed to enhance the knowledge level among these young athletes. This need for nutrition education has also been found in much of the previous research conducted that assessed level of nutrition knowledge (8-17,19).

The above results provide evidence that the Sport Nutrition Knowledge Questionnaire for Adolescent Athletes is a reliable tool when it is used in its entirety to assess the level of sport nutrition knowledge of this population. Future research and factor analysis would need to be conducted if there was a desire to use a subscale independently from the rest of the questionnaire. This research would have to focus on increasing the reliability of the subscales and the individual questions. Future research could also focus on the investigation of other factors that may be strong predictors of sport nutrition knowledge.

Limitations of the above research include the homogeneity of the subjects, which may have skewed the overall results since age was found to be a predictor of sport nutrition knowledge, and there was an unequal representation of ethnicity and gender. The small number of questions in the independent subscales, along with the level of ease of some of the questions within the subscales may have influenced the reliability of the subscales. The potential overlaps between construct areas within the individual questions may have increased the difficulty of determining distinct subscales of knowledge.

In conclusion, the developed knowledge assessment tool can practically be used for the assessment of the adolescent athlete population to evaluate knowledge for teams or individuals. It may also be used as an instrument to assess the effectiveness of sport

nutrition education programs and interventions, although this hypothesis has yet to be tested. The results of the data indicate that the strongest predictors of increased sport nutrition knowledge for this population were age and receiving nutrition information primarily from one's parents. Thus, interventions and educational workshops should be focused on educating and involving parents along with targeting younger athletes who do not have as much sport nutrition knowledge as their older teammates. Development of sport nutrition interventions and education programs should aim to increase the basic sport nutrition knowledge of the athletes, provide examples and ways to practically apply the learned information, and to dispel common nutrition myths with regard to sport nutrition. Overall, it is the responsibility of the educator and sport promoter to provide a non-threatening environment that is safe and healthy for the participating adolescent.

APPENDIX

ADOLESCENT SPORT NUTRITION KNOWLEDGE

QUESTIONNAIRE

The Adolescent Sport Nutrition Knowledge Questionnaire

Section 1 *Demographic Information*

What is your gender? (Please check **one**)

☐ Male ☐ Female

How old are you? _____**years old**

In the past 12 months, on how many organized sport teams (school, private league team, club, etc.) have you been for at least one season?

_____

List the sports in which you have participated for at least one season.

_____ _____ _____ _____

_____ _____

How many total years have you been involved in organized sport? _____

What kind of nutrition related classes have you attended?

(Please check **ALL** that apply)

☐ Health ☐ Foods and Nutrition ☐ Sports Medicine

☐ Nutrition counseling ☐ Sport nutrition seminar/workshops

☐ Other_____

In which high school class level/grade are you? (Please check only **one**)

☐ Freshman ☐ Sophomore ☐ Junior ☐ Senior

What is your ethnicity? (Please check only **one**)

☐ Caucasian ☐ African-American ☐ Hispanic ☐ Asian

☐ Native American ☐ Other_____

What/who is your primary source of nutrition information/education?

(Please check only ONE)

☐ Magazines ☐ Textbooks ☐ Friends ☐ Dietitian ☐ School teacher

☐ Physician ☐ Parents ☐ Athletic trainer ☐ Coach

☐ Internet websites ☐ Other medical professionals ☐ Health food store

How far in school did your father go? (Indicate the **highest** level)

☐ Did not finish high school

☐ Finished high school or got General Equivalency Diploma (GED)

☐ Did some college or training after high school

☐ Finished 4 year college

☐ Master's degree or PhD

☐ I don't know

How far in school did your mother go? (Indicate the **highest** level)

☐ Did not finish high school

☐ Finished high school or got General Equivalency Diploma (GED)

☐ Did some college or training after high school

☐ Finished 4 year college

☐ Master's degree or PhD

☐ I don't know

During the <u>past seven days</u>, how many days did all, or most, of your family living in your house eat at least one meal together?

☐ Never

☐ 1-2 days

☐ 3-4 days

☐ 5-6 days

☐ Every day

<u>Section 2</u>: *The following questions ask you about your nutrition attitudes and behaviors. Please check only **ONE** response for each of the following questions, unless stated otherwise. There are no right or wrong answers. Please answer each question honestly.*

On average, how many days per week do you eat breakfast?

☐0 ☐1-2 ☐3-4 ☐5-6 ☐7

Do you think healthful eating plays a role in improving sport performance?

☐Never ☐ Rarely ☐Sometimes ☐Often ☐Always

How often do you drink/ consume a sport drink during practice?

☐Never ☐ Rarely ☐Sometimes ☐Often ☐Always

How often do you skip meals (breakfast, lunch, dinner)?

☐Never ☐ Rarely ☐Sometimes ☐Often ☐Always

How many times do you eat per day (meals and snacks)?

☐0 ☐1-2 ☐3-4 ☐5-6 ☐>7

How many times per week do you eat fast food?

☐0 ☐1-2 ☐3-4 ☐5-6 ☐>7

What food(s) do you primarily choose when you go out to eat?

(Please check only **ONE**)

☐ Deli style sandwich ☐ Bagel ☐ Pizza ☐ Hamburger/fries ☐ Salad

☐ Hotdog/chicken nuggets ☐ Burrito ☐ Pasta or Rice bowl

☐ Other_____

On average, how many days per week do you bring your lunch from home?

☐0 ☐1-2 ☐3-4 ☐5-6 ☐7

On average, how many cups/servings/pieces of fruit (not counting juice) do you eat per day?

☐0 ☐1-2 ☐3-4 ☐5-6 ☐>7

How many cups/servings of vegetables (not counting potatoes) do you eat per day?

☐0 ☐1-2 ☐3-4 ☐5-6 ☐>7

How soon after practice do you drink a beverage with calories?

☐ Within 1 hour ☐ Within 2 hours ☐ Greater than 2 hours

How soon after practice or competition do you eat something?

☐ Within 1 hour ☐ Within 2 hours ☐ Greater than 2 hours

Eating healthful foods is important to me.

☐Never ☐ Rarely ☐Sometimes ☐Often ☐Always

Which dietary supplements do you take? (Please check **all** that apply)

☐ None ☐ Single or multi-vitamin/mineral supplement ☐ Protein powder/bar

☐ Sport bar/sport drink/gel/blocks ☐ Creatine ☐Other_____

In the past week, how many times did you help shop for groceries?

☐ Never ☐ 1 Time ☐ More than 1 time

In the past week, how many times did you help prepare food for dinner?

☐ Never ☐ 1-2 Times ☐ 3-4 Times ☐ 5-6 Times ☐ 7 Times

Section 3: *For the following questions please circle the most **correct** answer, if you do **not** know the answer please choose **Unknown (U/K)**. There is no penalty for choosing the unknown option.*

	Question	True	False	Un-known
1.	Protein is the most important source of energy (calories) for sport performance.	True	False	U/K
2.	Vitamin C and Vitamin E from the diet are important to help protect and repair muscles from damage.	True	False	U/K
3.	All athletes should take protein powders as a dietary supplement.	True	False	U/K
4.	Sport drinks are important to consume during intense practices longer than 60-90 minutes.	True	False	U/K
5.	Heat and humidity do **not** affect how much an athlete sweats during exercise.	True	False	U/K
6.	The B vitamins are important for turning the food you eat into energy.	True	False	U/K
7.	Calcium is important for bone health.	True	False	U/K
8.	Fiber from fruit, breakfast cereal, and vegetables is important for regular bowel movements.	True	False	U/K
9.	Feeling tired midway through a workout may be a sign of not eating enough food (calories).	True	False	U/K
10.	Carbohydrates (stored as muscle glycogen) are the most important energy source for high-intensity exercise.	True	False	U/K

	Question	True	False	Un-known
11.	Dehydration can cause muscle cramps.	True	False	U/K
12.	An athlete's pre-training or pre-competition meal should be high in protein.	True	False	U/K
13.	Eggs are **not** good sources of vitamins and minerals.	True	False	U/K
14.	Dehydration can negatively affect performance.	True	False	U/K
15.	There are **no** side effects associated with short-term steroid use.	True	False	U/K
16.	For 1 pound of weight loss after exercise an athlete should drink at least 3 cups (24 oz) of fluid.	True	False	U/K
17.	Sport drinks may enhance performance and speed recovery.	True	False	U/K
18.	Athletes need to eat frequently (every 2-3 hours).	True	False	U/K
19.	A recovery meal or snack should be eaten within 1-2 hours after exercise.	True	False	U/K
20.	How much an athlete sweats during exercise can be measured from the change in body weight before and after exercise.	True	False	U/K
21.	Athletes should limit the amount of salt they consume.	True	False	U/K
22.	Milk is a good source of calcium.	True	False	U/K
23.	Common low-fat protein foods include cheese, pizza. and fried chicken breast.	True	False	U/K
24.	Oils from plants, fish, nuts and seeds are considered healthful fats.	True	False	U/K
25.	The following body functions require energy (calories): growth, sleep, heartbeat, body temperature, and reproduction.	True	False	U/K

	Question	True	False	Un-known
26.	Taking steroids can cause acne, high cholesterol, and increased aggression.	True	False	U/K
27.	During exercise in the heat, drinking water is **better** than drinking sport drinks to maintain hydration.	True	False	U/K
28.	Vegetarian athletes need to consume a daily protein supplement because they cannot get enough protein from their diet.	True	False	U/K
29.	Creatine is an effective and safe supplement for athletes to take at any age.	True	False	U/K
30.	Juice, fruit, vegetables, and soup are good sources of fluid.	True	False	U/K
31.	White bread has the same amount of vitamins and minerals as whole wheat bread.	True	False	U/K
32.	To gain weight, an athlete has to eat more food (energy) than needed for exercise and body functions.	True	False	U/K
33.	Carbohydrates are the main fuel for mental performance.	True	False	U/K
34.	Weight loss occurs from not eating enough, exercising too much, or both.	True	False	U/K
35.	Oranges, strawberries and cantaloupe are good sources of Vitamin C.	True	False	U/K
36.	A pre-training or pre-competition meal should be consumed 2-4 hours prior to exercise.	True	False	U/K
37.	Vitamins and minerals provide energy (calories).	True	False	U/K
38.	Most of the time, athletes should follow a low-fat diet.	True	False	U/K
39.	Water helps maintain body temperature.	True	False	U/K
40.	While it is important to eat after exercise, what and how much is not essential.	True	False	U/K

	Question	True	False	Un-known
41.	Skipping breakfast does **not** affect physical or mental performance.	True	False	U/K
42.	Choosing a peanut butter and jelly sandwich with a sport drink is a good post-exercise snack.	True	False	U/K
43.	As long as enough calories are consumed, vitamin and mineral needs of an athlete are met.	True	False	U/K
44.	Dietary supplements are tested for purity (cleanliness) and safety before sale.	True	False	U/K
45.	Fruit juice is an ideal source of carbohydrate during exercise.	True	False	U/K
46.	If you are well hydrated, your urine should be clear to light yellow in color.	True	False	U/K
47.	When traveling, eating a turkey sandwich is a **better** choice for fueling performance than a cheeseburger with fries.	True	False	U/K
48.	Protein helps to build and repair muscle.	True	False	U/K
49.	Protein, carbohydrate, and fat all provide the same amount of calories per ounce.	True	False	U/K
50.	Most athletes require about four times more protein than non-athletes.	True	False	U/K
51.	A recovery meal should be high in carbohydrate, moderate in protein and fat, and contain adequate fluid and electrolytes.	True	False	U/K
52.	Eating a poor diet may increase an athlete's risk for injury or illness.	True	False	U/K
53.	Sport products (drinks, bars, gels) are **not** considered dietary supplements.	True	False	U/K
54.	Iron deficiency can cause increased tiredness.	True	False	U/K

	Question	True	False	Un-known
55.	Iron is found in meat, dark green vegetables, eggs, and fortified cereal.	True	False	U/K
56.	Fat is an important source of fuel at rest and during long-duration exercise.	True	False	U/K
57.	Meeting energy (calorie) needs promotes optimal performance and recovery.	True	False	U/K
58.	Common carbohydrate-rich foods are pasta, potato, cereal and bread.	True	False	U/K
59.	Consuming a snack or beverage with calories before weight lifting will promote muscle building.	True	False	U/K
60.	A multivitamin and mineral supplement **always** enhances performance.	True	False	U/K
61.	Refueling immediately after exercise with a sport drink and snack optimizes recovery.	True	False	U/K
62.	Sodium and potassium are key electrolytes for hydration.	True	False	U/K
63.	Whole milk is a better source of calcium than 2% or skim milk.	True	False	U/K

THANK YOU VERY MUCH FOR TAKING THE TIME TO FILL OUT THIS QUESTIONNAIRE

Please take a moment to fill in any questions you may have skipped.

INSTRUCTIONS FOR EXPERTS:

Overview:

We are developing a sport nutrition knowledge questionnaire for high school adolescent athletes. We have grouped the survey questions according to content areas, but want to make sure that we have put the individual questions in the correct content area. Here's where you come in.

Content Areas:

- **Behaviors and attitudes:** to identify the individual's current behaviors and attitudes pertaining to sport nutrition.
- **Energy Sources and Balance:** to assess the participant's knowledge of energy sources for exercise, energy content of macronutrients, and energy balance.
- **Macronutrients:** to assess the participant's knowledge of being able to identify food sources, their function, and recommendations.
- **Micronutrients:** to assess the participant's knowledge of being able to identify food sources, their function, and recommendations.
- **Hydration:** to assess the participant's knowledge of being able to identify hydration sources, their function, and recommendations.
- **Training Meal:** to test the participant's knowledge related to the composition, timing, and function of training and competition meals.
- **Supplements and Steroids:** to test the participant's knowledge in regards to concepts associated with dietary supplements.
- **Practical Application:** to evaluate the participant's ability to practically apply sport nutrition to specific athletic situations.

- *What we'd like you to do:*
  - Please provide your contact information so that we are able to contact you in regards to missing data, or any errors that may arise.

    Name:_____ e-mail:_____

    Phone:_____
  - Please rate each of the questions for the following criteria: Relevance to the content area, Readability, Item Difficulty, and Appropriateness for the high school adolescent athlete population. For each question, please circle a number between 1 and 4 (**1 = Not Relevant/Readable/Appropriate, 2 = Somewhat Relevant/Readable/Appropriate, 3 = Quite Relevant/Readable/Appropriate, 4 = Very Relevant/Readable/Appropriate**), indicating your opinion of how well each question represents the criteria. Please also offer specific suggestions on re-wording questions, if appropriate. On the following page we have an example.

Content Area	Question	Not Relevant	Somewhat Relevant	Quite Relevant	Very Relevant
Attitudes and Behaviors	Do you use a sport drink during practice?	1	2	3	(4)

*If you marked "Not Relevant", please explain why and recommend a better content area*_____

- For this example, the reviewer felt that this statement does represent the content area.
- Note that all of the questions are designed to be read silently by the individual participant.
- The response options for each of the questions is true/false/unknown.
- The questionnaire provides instructions for the participant to circle the best answer, and if they do not know the answer to select the *unknown* option.

Relevance to Content Area:

Content Area	*Survey Question*	Not Relevant	Somewhat Relevant	Relevant	Very Relevant
Attitudes and Behaviors	On average, how many days per week do you eat breakfast?	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	Do you think nutrition plays a role in enhancing sport performance?	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	Do you use a sport drink during practice?	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	How often do you skip meals?	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Relevant	Somewhat Relevant	Relevant	Very Relevant
Attitudes and Behaviors	How often do you eat per day (snacks/meals)?	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	How many days per week do you eat fast food?	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	When you eat out what food do you primarily choose?	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	On average, how many days per week do you bring your lunch from home?	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	How many cups of fruit (not counting juice) do you eat per day (1 cup= average size fist)?	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	How many cups of vegetables (not counting potatoes) do you eat per day (1 cup= average size fist)?	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	How soon after practice or competition do you eat and drink something?	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Relevant	Somewhat Relevant	Relevant	Very Relevant
Attitudes and Behaviors	I care about eating healthful food.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	Which dietary supplements do you take?	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	In the past week, how many times did you help prepare food for dinner?	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	In the past week, how many times did you help shop for groceries?	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Protein is the most important source of energy (calories) for sport performance.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Relevant	Somewhat Relevant	Relevant	Very Relevant
Energy Sources and Balance	Protein, carbohydrate, and fat all provide the same amount of calories per gram.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Vitamins and minerals provide energy (calories).	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Weight loss occurs from not eating enough and/or exercising too much.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Meeting energy (calorie) needs promotes optimal performance and recovery.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	To gain weight, an athlete has to eat more food (energy) than is required for exercise and body functions.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	The following body functions require energy (calories): growth, sleep, heart beat, body temperature, and reproduction.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Relevant	Somewhat Relevant	Relevant	Very Relevant
Energy Sources and Balance	Feeling tired midway through a workout may be a sign of not eating enough calories.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Carbohydrates (stored as muscle glycogen) are the most important energy source for high-intensity exercise.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Carbohydrates are the main fuel for mental performance.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Common carbohydrate-rich foods are pasta, potato, cereal and bread.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Protein helps to build and repair muscle.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Most athletes require about four times more protein than non-athletes.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Common foods high in lean protein include cheese, pizza, and fried chicken breast.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Relevant	Somewhat Relevant	Relevant	Very Relevant
Macro-nutrients	Oils from plants, fish, nuts and seeds are considered healthful fats.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Fat is an important source of fuel at rest and during long duration, low intensity exercise.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Most of the time, athletes should follow a low fat diet, ≤ 30% of daily calories.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Fiber from fruit, cereal, and vegetables is important for regular bowel movements.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Milk is a good source of calcium.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Calcium is important for bone health.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Whole milk is a better source of calcium than 2% or skim milk.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Relevant	Somewhat Relevant	Relevant	Very Relevant
Micro-nutrients	Iron deficiency can cause increased fatigue during exercise and delay the recovery after practice or competition.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Iron is found in meat, dark green vegetables, eggs, and fortified cereal.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Eggs are **not** good sources of vitamins and minerals.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Vitamin C and Vitamin E from the diet are important to help protect and repair muscles from damage.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Oranges, tomatoes and cantaloupe are good sources of vitamin C.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	The B vitamins are important for energy production.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	White bread has the same amount of vitamins and minerals as whole wheat bread.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Relevant	Somewhat Relevant	Relevant	Very Relevant
Micro-nutrients	Sodium (Na+) and potassium (K+) are key electrolytes for hydration and recovery.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Athletes should limit the amount of sodium (Na+) they consume.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Hyd-ration	A sport drink is **not** a good source of fluid to drink during and after intense exercise.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Hyd-ration	Dehydration can affect performance.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Hyd-ration	Low levels of sodium in the blood, along with dehydration can cause muscle cramps.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Hyd-ration	Heat and humidity do **not** affect how much an athlete sweats during exercise.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Hyd-ration	If you are hydrated, your urine should be clear to light yellow in color.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Ouestion*	Not Relevant	Somewhat Relevant	Relevant	Very Relevant
Hyd-ration	How much an athlete sweats during exercise can be measured from the change in body weight before and after exercise.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Hyd-ration	Water helps maintain body temperature and transport nutrients to the muscles.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Hyd-ration	Juice, fruit, vegetables, and soup are good sources of fluid from food.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Hyd-ration	Sport drinks are important to consume during intense practices longer than 60-90 minutes.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Training Meal	An athlete's pre-training or competition meal should be high in protein.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Training Meal	A pre-training or competition meal should be consumed 1-4 hours prior to exercise.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Training Meal	A recovery meal should be eaten within 1-2 hours after exercise.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Relevant	Somewhat Relevant	Relevant	Very Relevant
Training Meal	A recovery meal should be high in carbohydrate, moderate in protein and fat, and contain adequate fluid and electrolytes.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Training Meal	While it is important to eat after exercise, what and how much is not essential.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Training Meal	Athletes need to eat frequently.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Training Meal	Fruit juice is an ideal source of carbohydrate before, during or after exercise.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Training Meal	Skipping breakfast does **not** affect physical or mental performance.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Training Meal	Refueling after exercise with a sport drink and snack optimizes recovery.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Training Meal	Feeling tired may be a sign of not eating enough.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Relevant	Somewhat Relevant	Relevant	Very Relevant
Supplements & Steroids	There are **no** side effects associated with short-term steroid use.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Supplements & Steroids	Taking steroids can cause acne, high cholesterol, and increase aggression.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Supplements & Steroids	Dietary supplements are tested for purity and safety before sale.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Supplements & Steroids	Sport products (drinks, bars, gels) are **not** considered dietary supplements.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Supplements & Steroids	Sport drinks may enhance performance and speed recovery.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Supplements & Steroids	A multivitamin and mineral supplement **always** enhances performance.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Supplements & Steroids	Creatine is an effective and safe supplement for athletes to take at any age.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Relevant	Somewhat Relevant	Relevant	Very Relevant
Supplements & Steroids	All athletes should take protein powders as a dietary supplement.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Practical Application	Losing weight during an intense training period means that the athlete is in **positive** energy balance.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Practical Application	For 1 pound of weight loss after exercise an athlete should drink at least 3 cups of fluid.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Practical Application	During exercise in the heat, drinking water is better than drinking sport drink to maintain hydration status.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Practical Application	Vegetarian athletes need to consume a daily protein supplement because they cannot get enough protein from their diet.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Practical Application	Choosing a peanut butter and jelly sandwich with a sport drink is an example of refueling after exercise.	**1**	**2**	**3**	**4**
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Relevant	Somewhat Relevant	Relevant	Very Relevant
Practical Application	Weight lifting in the morning without eating will produce peak muscle gains.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Practical Application	As long as enough calories are consumed to stay in energy balance, vitamin and mineral needs of an athlete are met.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Practical Application	Not eating a balanced diet may increase an athlete's risk for injury or illness.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				
Practical Application	When traveling, choosing a turkey sandwich is a **better** choice for fueling performance than a cheeseburger with fries.	1	2	3	4
	If you marked "Not Relevant", please explain why and recommend a better content area:				
	_____				

Readability and Item Difficulty for the study population of adolescent athletes aged 14-19 years old:

Content Area	*Survey Question*	Not Readable	Somewhat Readable	Readable	Very Readable
Attitudes and Behaviors	On average, how many days per week do you eat breakfast?	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	Do you think sport nutrition plays a role in enhancing sport performance?	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	Do you use sport drink during practice?	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	How often do you skip meals?	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	How often do you eat per day (snacks/meals)?	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	How many days per week do you eat fast food?	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	When you eat out what do you primarily choose?	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Readable	Somewhat Readable	Readable	Very Readable
Attitudes and Behaviors	On average, how many days per week do you bring your lunch from home?	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
Attitudes and Behaviors	How many cups of fruit (not counting juice) do you eat per day (1 cup= average size fist)?	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
Attitudes and Behaviors	How many cups of vegetables (not counting potatoes) do you eat per day (1 cup= average size fist)?	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
Attitudes and Behaviors	How soon after practice or competition do you eat and drink something?	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
Attitudes and Behaviors	I care about eating healthy food.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
Attitudes and Behaviors	Which dietary supplements do you take?	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
Attitudes and Behaviors	In the past week, how many times did you help prepare food for dinner?	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				

Content Area	*Survey Question*	Not Readable	Somewhat Readable	Readable	Very Readable
Attitudes and Behaviors	In the past week, how many times did you help shop for groceries?	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Protein is the most important source of energy (calories) for sport performance.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Protein, carbohydrate, and fat all provide the same amount of calories per gram.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Vitamins and minerals provide energy (calories).	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Weight loss occurs from not eating enough and/or exercising too much.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Meeting energy (calorie) needs promotes optimal performance and recovery.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	To gain weight, an athlete has to eat more food (energy) than is required for exercise and body functions.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Readable	Somewhat Readable	Readable	Very Readable
Energy Sources and Balance	The following body functions require energy (calories): growth, sleep, heart beat, body temperature, and reproduction.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Feeling tired midway through a workout may be a sign of not eating enough calories.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Carbohydrates (stored as muscle glycogen) are the most important energy source for high-intensity exercise.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Carbohydrates are the main fuel for mental performance.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Common carbohydrate-rich foods are pasta, potato, cereal and bread.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Protein helps to build and repair muscle.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Most athletes require about four times more protein than non-athletes.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Readable	Somewhat Readable	Readable	Very Readable
Macro-nutrients	Common foods high in lean protein include cheese, pizza, and fried chicken breast.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Oils from plants, fish, nuts and seeds are considered healthful fats.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Fat is an important source of fuel at rest and during long duration, low intensity exercise.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Most of the time, athletes should follow a low fat diet, ≤ 30% of daily calories.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Fiber from fruit, cereal, and vegetables is important for regular bowel movements.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Milk is a good source of calcium.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Calcium is important for bone health.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Whole milk is a better source of calcium than 2% or skim milk.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Readable	Somewhat Readable	Readable	Very Readable
Micro-nutrients	Iron deficiency can cause increased fatigue during exercise and delay the recovery after practice or competition.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Iron is found in meat, dark green vegetables, eggs, and fortified cereal.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Eggs are **not** good sources of vitamins and minerals.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Vitamin C and Vitamin E from the diet are important to help protect and repair muscles from damage.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Oranges, tomatoes and cantaloupe are good sources of vitamin C.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	The B vitamins are important for energy production.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	White bread has the same amount of vitamins and minerals as whole wheat bread.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Readable	Somewhat Readable	Readable	Very Readable
Micro-nutrients	Sodium (Na+) and potassium (K+) are key electrolytes for hydration and recovery.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
Micro-nutrients	Athletes should limit the amount of sodium (Na+) they consume.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
Hydration	A sport drink is **not** a good source of fluid to drink during and after intense exercise.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
Hydration	Dehydration can affect performance.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
Hydration	Low levels of sodium in the blood, along with dehydration can cause muscle cramps.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
Hydration	Heat and humidity do **not** affect how much an athlete sweats during exercise.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
Hydration	If you are hydrated, your urine should be clear to light yellow in color.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				

Content Area	*Survey Question*	Not Readable	Somewhat Readable	Readable	Very Readable
Hydration	How much an athlete sweats during exercise can be measured from the change in body weight before and after exercise.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Hydration	Water helps maintain body temperature and transport nutrients to the muscles.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Hydration	Juice, fruit, vegetables, and soup are good sources of fluid from food.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Hydration	Sport drinks are important to consume during intense practices longer than 60-90 minutes.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Training Meal	An athlete's pre-training or competition meal should be high in protein.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Training Meal	A pre-training or competition meal should be consumed 1-4 hours prior to exercise.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Training Meal	A recovery meal should be eaten within 1-2 hours after exercise.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Readable	Somewhat Readable	Readable	Very Readable
Training Meal	A recovery meal should be high in carbohydrate, moderate in protein and fat, and contain adequate fluid and electrolytes.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Training Meal	While it is important to eat after exercise, what and how much is not essential.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Training Meal	Athletes need to eat frequently.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Training Meal	Fruit juice is an ideal source of carbohydrate before, during or after exercise.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Training Meal	Skipping breakfast does **not** affect physical or mental performance.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Training Meal	Refueling after exercise with a sport drink and snack optimizes recovery.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Training Meal	Feeling tired may be a sign of not eating enough.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Readable	Somewhat Readable	Readable	Very Readable
Supplements and Steroids	There are **no** side effects associated with short-term steroid use.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Supplements and Steroids	Taking steroids can cause acne, high cholesterol, and increase aggression.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Supplements and Steroids	Dietary supplements are tested for purity and safety before sale.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Supplements and Steroids	Sport products (drinks, bars, gels) are **not** considered dietary supplements.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Supplements and Steroids	Sport drinks may enhance performance and speed recovery.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Supplements and Steroids	A multivitamin and mineral supplement **always** enhances performance.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Supplements and Steroids	Creatine is an effective and safe supplement for athletes to take at any age.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Readable	Somewhat Readable	Readable	Very Readable
Supplements and Steroids	All athletes should take protein powders as a dietary supplement.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Practical Application	Losing weight during an intense training period means that the athlete is in **positive** energy balance.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Practical Application	For 1 pound of weight loss after exercise an athlete should drink at least 3 cups of fluid.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Practical Application	During exercise in the heat, drinking water is better than drinking sport drink to maintain hydration status.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Practical Application	Vegetarian athletes need to consume a daily protein supplement because they cannot get enough protein from their diet.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Practical Application	Choosing a peanut butter and jelly sandwich with a sport drink is an example of refueling after exercise.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Practical Application	Weight lifting in the morning without eating will produce peak muscle gains.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Readable	Somewhat Readable	Readable	Very Readable
Practical Application	As long as enough calories are consumed to stay in energy balance, vitamin and mineral needs of an athlete are met.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Practical Application	Not eating a balanced diet may increase an athlete's risk for injury or illness.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				
Practical Application	When traveling, choosing a turkey sandwich is a **better** choice for fueling performance than a cheeseburger with fries.	1	2	3	4
	If you marked "Not Readable", please explain why and recommend a better content area:				
	_____				

Appropriateness for the study population of adolescent athletes aged 14-19 years old:

Content Area	*Survey Question*	Not Appro-priate	Somewhat Appro-priate	Quite Appro-priate	Very Appro-priate
Attitudes and Behaviors	On average, how many days per week do you eat breakfast?	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	Do you think sport nutrition plays a role in enhancing sport performance?	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	Do you use sport drink during practice?	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	How often do you skip meals?	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	How often do you eat per day (snacks/meals)?	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	How many days per week do you eat fast food?	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Appro-priate	Somewhat Appro-priate	Quite Appro-priate	Very Appro-priate
Attitudes and Behaviors	When you eat out what do you primarily choose?	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	On average, how many days per week do you bring your lunch from home?	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	How many cups of fruit (not counting juice) do you eat per day (1 cup= average size fist)?	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	How many cups of vegetables (not counting potatoes) do you eat per day (1 cup= average size fist)?	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	How soon after practice or competition do you eat and drink something?	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	I care about eating healthy food.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Appro-priate	Somewhat Appro-priate	Quite Appro-priate	Very Appro-priate
Attitudes and Behaviors	Which dietary supplements do you take?	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Attitudes and Behaviors	In the past week, how many times did you help shop for groceries?	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Protein is the most important source of energy (calories) for sport performance.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Protein, carbohydrate, and fat all provide the same amount of calories per gram.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Vitamins and minerals provide energy (calories).	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Weight loss occurs from not eating enough and/or exercising too much.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Appro-priate	Somewhat Appro-priate	Quite Appro-priate	Very Appro-priate
Energy Sources and Balance	Meeting energy (calorie) needs promotes optimal performance and recovery.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	To gain weight, an athlete has to eat more food (energy) than is required for exercise and body functions.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	The following body functions require energy (calories): growth, sleep, heart beat, body temperature, and reproduction.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Energy Sources and Balance	Feeling tired midway through a workout may be a sign of not eating enough calories.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Carbohydrates (stored as muscle glycogen) are the most important energy source for high-intensity exercise.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Carbohydrates are the main fuel for mental performance.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Appro-priate	Somewhat Appro-priate	Quite Appro-priate	Very Appro-priate
Macro-nutrients	Common carbohydrate-rich foods are pasta, potato, cereal and bread.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Protein helps to build and repair muscle.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Appro-priate	Somewhat Appro-priate	Quite Appro priate	Very Appro-priate
Macro-nutrients	Most athletes require about four times more protein than non-athletes.	**1**	**2**	**3**	**4**
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Common foods high in lean protein include cheese, pizza, and fried chicken breast.	**1**	**2**	**3**	**4**
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Oils from plants, fish, nuts and seeds are considered healthful fats.	**1**	**2**	**3**	**4**
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Fat is an important source of fuel at rest and during long duration, low intensity exercise.	**1**	**2**	**3**	**4**
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Most of the time, athletes should follow a low fat diet, ≤ 30% of daily calories.	**1**	**2**	**3**	**4**
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Macro-nutrients	Fiber from fruit, cereal, and vegetables is important for regular bowel movements.	**1**	**2**	**3**	**4**
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Milk is a good source of calcium.	**1**	**2**	**3**	**4**
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Appro-priate	Somewhat Appro-priate	Quite Appro-priate	Very Appro-priate
Micro-nutrients	Calcium is important for bone health.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Whole milk is a better source of calcium than 2% or skim milk.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Iron deficiency can cause increased fatigue during exercise and delay the recovery after practice or competition.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Iron is found in meat, dark green vegetables, eggs, and fortified cereal.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Eggs are **not** good sources of vitamins and minerals.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Vitamin C and Vitamin E from the diet are important to help protect and repair muscles from damage.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Micro-nutrients	Oranges, tomatoes and cantaloupe are good sources of vitamin C.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Appro-priate	Somewhat Appro-priate	Quite Appro-priate	Very Appro-priate
Micro-nutrients	The B vitamins are important for energy production. *If you marked "Not Appropriate", please explain why and recommend a better content area:* _____	1	2	3	4
Micro-nutrients	White bread has the same amount of vitamins and minerals as whole wheat bread. *If you marked "Not Appropriate", please explain why and recommend a better content area:* _____	1	2	3	4
Micro-nutrients	Sodium (Na+) and potassium (K+) are key electrolytes for hydration and recovery. *If you marked "Not Appropriate", please explain why and recommend a better content area:* _____	1	2	3	4
Micro-nutrients	Athletes should limit the amount of sodium (Na+) they consume. *If you marked "Not Appropriate", please explain why and recommend a better content area:* _____	1	2	3	4
Hyd-ration	A sport drink is **not** a good source of fluid to drink during and after intense exercise. *If you marked "Not Appropriate", please explain why and recommend a better content area:* _____	1	2	3	4
Hyd-ration	Dehydration can affect performance. *If you marked "Not Appropriate", please explain why and recommend a better content area:* _____	1	2	3	4
Hyd-ration	Low levels of sodium in the blood, along with dehydration can cause muscle cramps. *If you marked "Not Appropriate", please explain why and recommend a better content area:* _____	1	2	3	4

Content Area	*Survey Question*	Not Appro-priate	Somewhat Appro-priate	Quite Appro-priate	Very Appro-priate
Hydration	Heat and humidity do **not** affect how much an athlete sweats during exercise.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Hydration	If you are hydrated, your urine should be clear to light yellow in color.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Hydration	How much an athlete sweats during exercise can be measured from the change in body weight before and after exercise.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Hydration	Water helps maintain body temperature and transport nutrients to the muscles.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Hydration	Juice, fruit, vegetables, and soup are good sources of fluid from food.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Hydration	Sport drinks are important to consume during intense practices longer than 60-90 minutes.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Appro-priate	Somewhat Appro-priate	Quite Appro-priate	Very Appro-priate
Training Meal	An athlete's pre-training or competition meal should be high in protein.	**1**	**2**	3	**4**
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Training Meal	A pre-training or competition meal should be consumed 1-4 hours prior to exercise.	**1**	**2**	**3**	**4**
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Training Meal	A recovery meal should be eaten within 1-2 hours after exercise.	**1**	**2**	**3**	**4**
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Training Meal	A recovery meal should be high in carbohydrate, moderate in protein and fat, and contain adequate fluid and electrolytes.	**1**	**2**	**3**	**4**
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Training Meal	While it is important to eat after exercise, what and how much is not essential.	**1**	**2**	**3**	**4**
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Training Meal	Athletes need to eat frequently.	**1**	**2**	**3**	**4**
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Appro-priate	Somewhat Appro-priate	Quite Appro-priate	Very Appro-priate
Training Meal	Fruit juice is an ideal source of carbohydrate before, during or after exercise.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
Training Meal	Skipping breakfast does **not** affect physical or mental performance.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
Training Meal	Refueling after exercise with a sport drink and snack optimizes recovery.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
Training Meal	Feeling tired may be a sign of not eating enough.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
Supplements and Steroids	There are **no** side effects associated with short-term steroid use.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
Supplements and Steroids	Taking steroids can cause acne, high cholesterol, and increase aggression.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
Supplements and Steroids	Dietary supplements are tested for purity and safety before sale.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				

Content Area	*Survey Question*	Not Appro-priate	Somewhat Appro-priate	Quite Appro-priate	Very Appro-priate
Supplements and Steroids	Sport products (drinks, bars, gels) are **not** considered dietary supplements.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Supplements and Steroids	Sport drinks may enhance performance and speed recovery.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Supplements and Steroids	A multivitamin and mineral supplement **always** enhances performance.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Supplements and Steroids	Creatine is an effective and safe supplement for athletes to take at any age.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Supplements and Steroids	All athletes should take protein powders as a dietary supplement.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Practical Application	Losing weight during an intense training period means that the athlete is in **positive** energy balance.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Appro-priate	Somewhat Appro-priate	Quite Appro-priate	Very Appro-priate
Practical Application	For 1 pound of weight loss after exercise an athlete should drink at least 3 cups of fluid.	**1**	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Practical Application	During exercise in the heat, drinking water is better than drinking sport drink to maintain hydration status.	**1**	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Practical Application	Vegetarian athletes need to consume a daily protein supplement because they cannot get enough protein from their diet.	**1**	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Practical Application	Choosing a peanut butter and jelly sandwich with a sport drink is an example of refueling after exercise.	**1**	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Practical Application	Weight lifting in the morning without eating will produce peak muscle gains.	**1**	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				

Content Area	*Survey Question*	Not Appro-priate	Somewhat Appro-priate	Quite Appro-priate	Very Appro-priate
Practical Application	As long as enough calories are consumed to stay in energy balance, vitamin and mineral needs of an athlete are met.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Practical Application	Not eating a balanced diet may increase an athlete's risk for injury or illness.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				
Practical Application	When traveling, choosing a turkey sandwich is a **better** choice for fueling performance than a cheeseburger with fries.	1	2	3	4
	If you marked "Not Appropriate", please explain why and recommend a better content area:				
	_____				

Other Comments:

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THANK YOU FOR YOUR TIME!

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